



Associations between Body Size Measurements and Milk Production in Lactating Crossbred Friesian-Holstein Dairy Cattle at the KUD Jaya Abadi, Blitar City

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Abstract. This study aims to identify and measure the relationships between body size measurements, including body length (BL), chest circumference (CC), chest width (CW) and body height (BH), in Lactating Crossbred Friesian-Holstein at KUD Jaya Abadi, Blitar. The study used a survey method and direct measurement, involving 100 lactating cows from the 1st to the 5th lactation period. Data were analyzed using correlation and multiple linear regression. The results did not indicate significant correlations between BL, CC, CW, and BH with milk production ($p > 0.05$). The correlation coefficient (r) and determination coefficient (R^2) indicated a low relationship between body size measurements and milk production. Specifically, the r and R^2 values were as follows: 0.24 and 1.8 %. In conclusion, there was no significant relationship between body size measurements and milk production. It is therefore recommended that body size measurements not be utilized as the primary criteria for selecting breeding stock. The focus should instead be directed toward actual milk production records, reproductive history, and health parameters, as these factors are likely to exert greater influence on productivity and should be prioritized in breeding decisions. Future research should consider additional variables and the classification of populations based on productivity levels.

Keywords: body length, chest circumference, chest width and body height, milk production.

1 Introduction

Dairy cows are a type of ruminant livestock that fulfil the need for nutritious food in the form of milk. Along with the increase in human population, the demand for milk has also increased, but milk production from dairy cows has not been able to catch up with this rise in demand. To meet the national milk demand, more planned management is needed so that milk production increases every year. Crossbred Friesian Holstein (FH) dairy cows are the most widely kept breed in Indonesia. Efforts to increase domestic milk production are made by increasing the productivity of FH dairy cows that have adapted to Indonesia while maintaining their purity. According to [1], milk production can be influenced by several factors, namely breed and individual, lactation,

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milk secretion, milking, age, estrous cycle, dry period, feed quality, environmental conditions, and disease. Healthy cows will produce quality milk in optimal quantities. Another factor that affects milk production is body size. Cows with longer body lengths, greater heights, heavier body weights, and wider chest girths generally showed higher milk yields [2]. The milk yield of dairy cows can be estimated based on their body length [3]. Body length is an indicator of the growth and development of livestock (exterior) and is expected to provide an overview of the milk production of dairy cows in KUD Jaya Abadi Blitar. In addition, the height, chest circumference and chest width of dairy cows also play a role in determining the amount of milk production per day. Based on this, Despite the widespread use of body size measurements as indirect predictors of milk yield, limited studies have evaluated this association under smallholder cooperative farming systems in Indonesia. This study investigates the relationships between body measurements and milk production in crossbred Friesian-Holstein cows managed by KUD Jaya Abadi in Blitar, aiming to assess the relevance of morphometric selection criteria in practical field conditions.

2 Materials and Methods

The sample used for this study was 100 Crossbred Friesian Holstein owned by KUD Jaya Abadi Blitar, East Java. Data taken included milk production and body size measures (body length, chest circumference, chest width, body height). The tools used in the study were a measuring tape to measure chest circumference and a measuring stick to measure body length, chest width and height. The tools to measure milk production were a 10-litre-capacity measuring bucket and a 1-litre capacity measuring cup. Milk production was measured every day for one month. This research method used a survey method, while the determination of samples by purposive sampling, namely cows that were in lactation 1-5 periods. The collected data was subsequently examined through correlation analysis and multiple linear regression. Then, the analysis was conducted using Excel, employing regression formulas. Associations between body size measurements and milk production are determined using the regression equation formula provided below:

$$Y = \alpha + \beta_1. X_1 + \beta_n. X_n \quad (1)$$

Description:

Y = Milk production

α = Constant

$\beta_{1,2,3,4}$ = Partial regression coefficient of body length, chest circumference, chest width and height

X_1 = Body Length (cm)

X_2 = Chest Circumference (cm)

X_3 = Chest Width (cm)

X_4 = Body Height (cm)

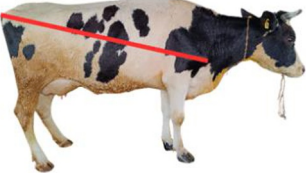
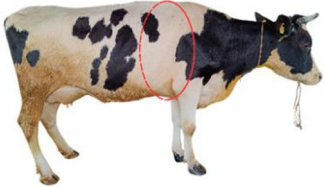
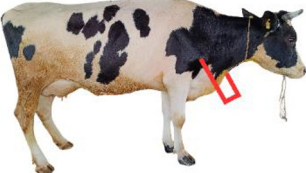
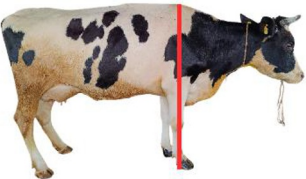
The guidelines for interpreting the correlation between variables X and Y, as outlined by [4] are presented in Table 1.

Table 1. The guidelines for interpreting the correlation between variables X and Y

Correlation (r)	Interpretation
0.00 - 0.199	Very low correlation
0.20 - 0.399	Low correlation
0.40 - 0.599	Moderate correlation
0.60 - 0.799	High correlation
0.80 - 1.000	Very high correlation

Body size measures (body length, chest circumference, chest width, body height) according to Table 2.

Table 2. The method of measuring body size uses the reference from [5].

No	Body Size Measurement	Measurement Method	Image
1	Body Length	Cattle body length is measured using a measuring stick placed from the ischii tuber (pelvic bone) to the humeral tuberosity (tip of the upper arm bone).	
2	Chest Circumference	To measure the circumference of a cow's chest, you should use a tape measure placed directly behind the cow's scapula or shoulder bone.	
3	Chest Width	Measurement of chest width in dairy cows uses a measuring stick positioned between the two inner elbows of the cow.	
4	Body Height	Cattle shoulder height is measured using a measuring stick placed vertically, starting from the highest part of the shoulder and passing behind the scapula to ground level.	

3 Results and Discussion

The average milk production is around 11.60 ± 3.78 liters/head/day, while the average body length is 179.17 ± 8.20 cm; chest circumference 152.79 ± 7.89 cm; chest width 20.63 ± 1.85 cm and body height 133.57 ± 5.16 . Based on the results of the study showed that the relationship of body size measurements with milk production of FH cows can be seen in Table 3.

Table 3. Correlation coefficient and determination and regression equation of body size measurements with Milk Production of FH dairy cows.

Variable	Correlation Coefficient (r)	Determination Coefficient R2 (%)	Regression	Sig-F
Body Measurements	0.240	1.8%	$Y = 10.63 + 0.07 (X_1) - 0.09 (X_2) - 0.031 (X_3) + 0.06 (X_4)$	0.22

The results of multiple linear regression analysis obtained regression equation $Y = 10.63 + 0.07 (X_1) - 0.09 (X_2) - 0.031 (X_3) + 0.06 (X_4)$. The results showed body size measurements had no significant effect on milk production. The correlation coefficient is 0.240, indicating a low correlation between body size measurements and milk production. The coefficient of determination is 0.018, this result shows that body length, chest circumference, chest width and height affect 1.8% while 98.2% is influenced by other factors. Since the significance value (0.22) is greater than 0.05, body size measurements do not significantly affect the milk production of FH dairy cows in KUD Jaya Abadi Blitar.

Previous studies have reported mixed findings on the relationship between body size measurements and milk production in dairy cows. [6] found that vital statistics such as chest circumference, body length, and height did not significantly affect milk production in the Merapi Singgalang cooperative in Padang Panjang City. Similarly, [7] reported no correlation between chest circumference and milk production, although they did find a correlation between body length and milk yield. On the other hand, [8] concluded that chest circumference, body length, body height, and udder circumference were not correlated with milk production, with the exception of udder height, which showed a significant relationship with milk yield. In contrast, [2] found that body size measurements, including body length, height, chest girth, and body weight, influenced milk production in Friesian-Holstein cows. These discrepancies in findings may be attributed to differences in genetics, husbandry practices, feeding management, and overall milk production capacity among dairy cows. While our study suggests that body size measurements do not have a significant effect on milk production, it is important to recognise that body size still plays a critical role in dairy cow productivity. Cows with well-proportioned body structures generally have a greater capacity to support milk production. According to [2] cows with longer bodies, greater heights, heavier weights, and broader chest girths tend to produce higher milk yields. Among these traits, chest

girth is considered the most influential factor, followed by body height, body length, and lactation period.

Body size reflects the size of the digestive apparatus, which is related to food storage capacity. Larger body size reflects that the cow can eat more and therefore produce more milk. A longer lactation period indicates an older age, where body development, especially chest circumference, increases. Body size can indicate the body condition of cattle, for example, estimation of body weight based on chest circumference and body length. according to [9] cattle with large body weights use less energy for basic needs so that the remaining energy can be used for milk production.

There is a significant relationship between the depth of the rear udder, udder length and width of the rear udder and the distance between the front nipples with milk production [10]. In addition, factors that affect milk production are breed [2]; milking time interval [11]; and the amount of feed [12]. Added by [13], factors that play a role in dairy milk production include genetic aspects, feed and nutrition, health management, environmental conditions, reproductive management, maintenance management, and the use of technology.

4 Conclusion

This study examined the relationship between body size measurements, including body length, chest circumference, chest width, and body height and milk production in Friesian-Holstein dairy cows at KUD Jaya Abadi, Blitar. The findings indicate that these body size measurements do not have a significant effect on milk production. This suggests that milk production is predominantly influenced by other factors beyond body size, such as genetics, nutrition, management practices, and environmental conditions.

Disclosure of Interests. The authors have no competing interests to declare that are relevant to the content of this article.

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